

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
REQUEST FOR FILING NATIONAL PHASE OF
PCT APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

10/049610

To: Hon. Commissioner of Patents
Washington, D.C. 20231

J1132 U.S. PTO



02/14/02



00909

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)

Atty Dkt: P 0284989 /C295.03/I
M# /Client Ref.

From: Pillsbury Winthrop LLP, IP Group:

Date: February 14, 2002

This is a **REQUEST** for **FILING** a PCT/USA National Phase Application based on:

- | | | |
|-------------------------------------|------------------------------|-----------------------------------|
| 1. International Application | 2. International Filing Date | 3. Earliest Priority Date Claimed |
| PCT/GB00/02794 | 20 July 2000 | 14 August 1999 |
| ↑ country code | Day MONTH Year | Day MONTH Year |
| (use item 2 if no earlier priority) | | |
4. Measured from the earliest priority date in item 3, this PCT/USA National Phase Application Request is being filed within:
- (a) ☐ 20 months from above item 3 date (b) ☒ 30 months from above item 3 date,
- (c) Therefore, the due date (unextendable) is February 14, 2002
5. Title of Invention Thermally-Transferable Polyester Image-Protecting Layer

6. Inventor(s) Julie Caroline Double, Andrew Clifton and Alan Butters

Applicant herewith submits the following under 35 U.S.C. 371 to effect filing:

7. ☒ Please immediately start national examination procedures (35 U.S.C. 371 (f)).
8. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)) is transmitted herewith (file if in English but, if in foreign language, file only if not transmitted to PTO by the International Bureau) including:
- a. ☒ Request;
- b. ☒ Abstract;
- c. 22 pgs. Spec. and Claims;
- d. ___ sheet(s) Drawing which are ☐ informal ☐ formal of size ☐ A4 ☐ 11"
9. ☒ A copy of the International Application has been transmitted by the International Bureau.
10. A translation of the International Application into English (35 U.S.C. 371(c)(2))
- a. ☐ is transmitted herewith including: (1) ☐ Request; (2) ☐ Abstract;
- (3) ___ pgs. Spec. and Claims;
- (4) ___ sheet(s) Drawing which are: ☐ informal ☐ formal of size ☐ A4 ☐ 11"
- b. ☒ is not required, as the application was filed in English.
- c. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
- d. ☐ Translation verification attached (not required now).

11. ☒ Please see the attached Preliminary Amendment
12. ☐ Amendments to the claims of the International Application **under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., before 18th month from first priority date above in item 3, are transmitted herewith (file only if in English) including:**
13. ☒ PCT Article 19 claim amendments (if any) have been transmitted by the International Bureau
14. ☐ Translation of the amendments to the claims **under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., of claim amendments made before 18th month, is attached (required by 20th month from the date in item 3 if box 4(a) above is X'd, or 30th month if box 4(b) is X'd, or else amendments will be considered canceled).**
15. **A declaration of the inventor (35 U.S.C. 371(c)(4))**
a. ☐ is submitted herewith ☐ Original ☐ Facsimile/Copy
b. ☒ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
16. **An International Search Report (ISR):**
a. Was prepared by ☒ European Patent Office ☐ Japanese Patent Office ☐ Other
b. ☒ has been transmitted by the international Bureau to PTO.
c. ☒ copy herewith (2 pg(s).) ☒ plus Annex of family members (1 pg(s).).
17. **International Preliminary Examination Report (IPER):**
a. ☒ has been transmitted (if this letter is filed after 28 months from date in item 3) in English by the International Bureau with Annexes (if any) in original language.
b. ☒ copy herewith in English.
c.1 ☐ IPER Annex(es) in original language ("Annexes" are amendments made to claims/spec/drawings during Examination) including attached amended:
c.2 ☐ Specification/claim pages #__ claims #
Dwg Sheets #
d. ☐ Translation of Annex(es) to IPER **(required by 30th month due date, or else annexed amendments will be considered canceled).**
18. **Information Disclosure Statement** including:
a. ☒ Attached Form PTO-1449 listing documents
b. ☒ Attached copies of documents listed on Form PTO-1449
c. ☒ A concise explanation of relevance of ISR references is given in the ISR.
19. ☐ **Assignment** document and Cover Sheet for recording are attached. Please mail the recorded assignment document back to the person whose signature, name and address appear at the end of this letter.
20. ☐ Copy of Power to IA agent.
21. ☐ **Drawings** (complete only if 8d or 10a(4) not completed): __ sheet(s) per set: ☐ 1 set informal; ☐ Formal of size ☐ A4 ☐ 11"
22. Small Entity Status ☒ is **Not** claimed ☐ is claimed (**pre-filing confirmation required**)
22(a) __ (No.) Small Entity Statement(s) enclosed (since 9/8/00 Small Entity Statements(s) not essential to make claim)
23. **Priority** is hereby claimed under 35 U.S.C. 119/365 based on the priority claim and the certified copy, both filed in the International Application during the international stage based on the filing in (country) Great Britain of:
- | | <u>Application No.</u> | <u>Filing Date</u> | | <u>Application No.</u> | <u>Filing Date</u> |
|-----|------------------------|--------------------|-----|------------------------|--------------------|
| (1) | 9919159.5 | 14 August 1999 | (2) | | |
| (3) | | | (4) | | |
| (5) | | | (6) | | |
- a. ☒ See Form PCT/IB/304 sent to US/DO with copy of priority documents. If copy has not been received, please proceed promptly to obtain same from the IB.
b. ☐ Copy of Form PCT/IB/304 attached.

24. Attached:

25. Per Item 17.c2, **cancel original** pages # __, claims # __, Drawing Sheets #**26. Calculation of the U.S. National Fee (35 U.S.C. 371 (c)(1)) and other fees is as follows:**Based on amended claim(s) per above item(s) ☐ 12, ☐ 14, ☐ 17, ☐ 25 (hilitte)

Total Effective Claims	20	minus 20 =	0	x \$18/\$9	=	\$0	966/967
Independent Claims	3	minus 3 =	0	x \$84/\$42	=	\$0	964/965
If any proper (ignore improper) Multiple Dependent claim is present,				add \$280/\$140	+	0	968/969

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(4)): →→ BASIC FEE REQUIRED, NOW →→→→

A. If country code letters in item 1 are not "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA"

See item 16 re:

1. Search Report was <u>not</u> prepared by EPO or JPO -----	add \$1,040/\$52		960/961
	0		
2. Search Report was prepared by EPO or JPO -----	add \$890/\$445	+890	970/971

SKIP B, C, D AND E UNLESS country code letters in item 1 are "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN", "ZA", "LC" or "PH"

→ <input type="checkbox"/> B. If USPTO did not issue both International Search Report (ISR) and (if box 4(b) above is X'd) the International Examination Report (IPER), -----	add \$1,040/\$52	+0	960/961
(X)	0		
(only) → <input type="checkbox"/> C. If USPTO issued ISR but not IPER (or box 4(a) above is X'd), -----	add \$740/\$370	+0	958/959
(one) → <input type="checkbox"/> D. If USPTO issued IPER but IPER Sec. V boxes not all 3 YES, -----	add \$710/\$355	+0	956/957
(of)			
(these) → <input type="checkbox"/> E. If international preliminary examination fee was paid to USPTO and Rules 492(a)(4) and 496(b) satisfied (in IPER Sec. V <u>all</u> 3 boxes <u>must</u> be YES for <u>all</u> claims), --	add \$100/\$50	+0	962/963
(4) →			
(boxes)			

27. **SUBTOTAL = \$890**

28. If Assignment box 19 above is X'd, add Assignment Recording fee of ----\$40 +0 (581)

29. If box 15a is x'd, determine whether inventorship on Declaration is different than in international stage. If yes, add (per Rule 497(d)) ----\$130 +0 (098)

30. Attached is a check to cover the ----- **TOTAL FEES \$890**

Our Deposit Account No. 03-3975

Our Order No. 041301 | 0284989
C# M#

00909

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 and 492 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed**Pillsbury Winthrop LLP**
Intellectual Property GroupBy Atty: Richard A. SteinbergReg. No. 26,588Sig: Richard A. SteinbergFax: (703) 905-2500
Tel: (703) 905-2039

Atty/Sec: RAS/kmh

NOTE: File in duplicate with 2 postcard receipts (PAT-103) & attachments.

3. (Amended) A thermal transfer medium according to claim 1, wherein the polyester has a Tg of at least 75°C.
4. (Amended) A thermal transfer medium according to claim 1, wherein the polyester has a Tg of about 77°C and a molecular weight of about 7,500.

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5. (Amended) A thermal transfer medium according to claim 1, wherein the coating further comprises filler material.
6. (Amended) A thermal transfer medium according to claim 1, wherein the coating further comprises one or more ultra-violet light absorbers.
7. (Amended) A thermal transfer medium according to claim 1, wherein the coating further comprises one or more optical brighteners.
8. (Amended) A thermal transfer medium according to claim 1, wherein the substrate comprises a film of heat-resistant material selected from polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane.
9. (Amended) A thermal transfer medium according to claim 1, wherein the coating has a thickness in the range 0.5 to 5.0 μ m, preferably 1.5 to 3.5 μ m, typically 1.6 to 2.0 μ m.
10. (Amended) A thermal transfer medium according to claim 1, further comprising a subcoat between the substrate and coating.
12. (Amended) A thermal transfer medium according to claim 1, wherein the other surface of the substrate has a heat-resistant backcoat.
15. (Amended) A method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with claim 1 and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.
17. (Amended) Receiver material bearing an overlay produced by the method of claim 15.
19. (Amended) Receiver material according to claim 17, wherein the receiver material has an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer.

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20. (Amended) Receiver material according to claim 17 in the form of an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

Please refer to the attached Appendix for changes made to the above claims.

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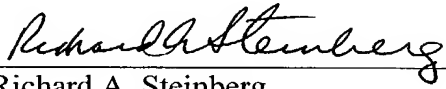
REMARKS

The present amendment adds reference to the priority applications to the specification and further amends Claims 3-10, 12, 15, 17 and 19-20 to remove multiple dependencies from the claims. No new matter has been added.

Favorable action on the merits is respectfully requested.

Respectfully submitted,

PILLSBURY WINTHROP LLP

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Date: February 14, 2002
Attorney Reference: 041301/0284989

Attachment: Appendix

11. (Amended) A thermal transfer medium according to claim 1 [or 2], wherein the polyester has a Tg of at least 75°C.
12. (Amended) A thermal transfer medium according to claim 1 [or 2], wherein the polyester has a Tg of about 77°C and a molecular weight of about 7,500.
13. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating further comprises filler material.
14. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating further comprises one or more ultra-violet light absorbers.
15. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating further comprises one or more optical brighteners.
16. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the substrate comprises a film of heat-resistant material selected from polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane.
17. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating has a thickness in the range 0.5 to 5.0µm, preferably 1.5 to 3.5µm, typically 1.6 to 2.0µm.
18. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, further comprising a subcoat between the substrate and coating.
13. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the other surface of the substrate has a heat-resistant backcoat.

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15. (Amended) A method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with [any one of claims 1 to 13] claim 1 and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.
18. (Amended) Receiver material bearing an overlay produced by the method of claim 15 [or 16].
19. (Amended) Receiver material according to claim 17 [or 18], wherein the receiver material has an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer.
20. (Amended) Receiver material according to claim 17[, 18 or 19,] in the form of an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

Rec'd PCT/PTO 06 JUN 2002

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION OF

BOX PCT

Inventors: Julie C. Double et al.

Application Serial No. 10/049,610

Filed: February 14, 2002

Title: *THERMALLY-TRANSFERABLE POLYESTER IMAGE-PROTECTING LAYER***SUPPLEMENTAL PRELIMINARY AMENDMENT**

Hon. Commissioner of Patents
Washington, D.C. 20231

Sir:

Prior to prosecution on the merits, please enter the following Supplemental Preliminary Amendment in place of the Preliminary Amendment filed concurrently with the application on February 14, 2002.

In the Claims

Kindly amend the claims as follows:

3. (Amended) A thermal transfer medium according to claim 1, wherein the polyester has a Tg of about 80°C and a molecular weight of about 7,000.
4. (Amended) A thermal transfer medium according to claim 1, wherein the polyester has a Tg of about 77°C and a molecular weight of about 7,500.
5. (Amended) A thermal transfer medium according to claim 1, wherein the coating further comprises filler material.
6. (Amended) A thermal transfer medium according to claim 1, wherein the coating further comprises one or more ultra-violet light absorbers.
7. (Amended) A thermal transfer medium according to claim 1, wherein the coating further comprises one or more optical brighteners.

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8. (Amended) A thermal transfer medium according to claim 1, wherein the substrate comprises a film of heat-resistant material selected from polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane.
9. (Amended) A thermal transfer medium according to claim 1, wherein the coating has a thickness in the range 0.5 to 5.0µm.
10. (Amended) A thermal transfer medium according to claim 1, further comprising a subcoat between the substrate and coating.
12. (Amended) A thermal transfer medium according to claim 1, wherein the other surface of the substrate has a heat-resistant backcoat.
15. (Amended) A method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with claim 1 and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.
17. (Amended) Receiver material bearing an overlay produced by the method of claim 15.
19. (Amended) Receiver material according to claim 17, wherein the receiver material has an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer.
20. (Amended) Receiver material according to claim 17 in the form of an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

Please refer to the attached Appendix for changes made to the above claims.

Preliminary Amendment

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REMARKS

It is respectfully requested that the Examiner enter the present Supplemental Preliminary Amendment in place of the Preliminary Amendment filed concurrently with the Application.

The present Supplemental Preliminary Amendment corrects inadvertent typographical errors with respect to the claim numbering contained in the Appendix of the Preliminary Amendment. An additional change has also been made to claim 3.

No new matter has been added.

Favorable action on the merits is respectfully requested.

Respectfully submitted,

PILLSBURY WINTHROP LLP

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Date: June 6, 2002
Attorney Reference: 041301/0284989

Attachment: Appendix

*Preliminary Amendment*Attorney Reference: 041301/0284989

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APPENDIX: VERSION TO SHOWS CHANGES MADE TO APPLICATION**In the Claims**

The claims were amended as follows:

3. (Amended) A thermal transfer medium according to claim 1 [or 2], wherein the polyester has a Tg of [at least 75°C] about 80°C and a molecular weight of about 7,000.
4. (Amended) A thermal transfer medium according to claim 1 [or 2], wherein the polyester has a Tg of about 77°C and a molecular weight of about 7,500.
5. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating further comprises filler material.
6. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating further comprises one or more ultra-violet light absorbers.
7. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating further comprises one or more optical brighteners.
8. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the substrate comprises a film of heat-resistant material selected from polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane.
9. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the coating has a thickness in the range 0.5 to 5.0µm[, preferably 1.5 to 3.5µm, typically 1.6 to 2.0µm].
10. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, further comprising a subcoat between the substrate and coating.
12. (Amended) A thermal transfer medium according to [any one of the preceding claims] claim 1, wherein the other surface of the substrate has a heat-resistant backcoat.

*Preliminary Amendment*Attorney Reference: 041301/0284989

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15. (Amended) A method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with [any one of claims 1 to 13] claim 1 and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.
17. (Amended) Receiver material bearing an overlay produced by the method of claim 15 [or 16].
19. (Amended) Receiver material according to claim 17 [or 18], wherein the receiver material has an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer.
20. (Amended) Receiver material according to claim 17[, 18 or 19,] in the form of an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

Title: THERMALLY-TRANSFERABLE POLYESTER IMAGE-PROTECTING LAYER

Field of the Invention

This invention relates to thermal transfer printing and concerns a thermal transfer medium, a method of making the medium, a method of forming an overlay on a receiver material and the resulting receiver material bearing an overlay.

Background to the Invention

Dye diffusion thermal transfer printing is a well known process in which one or more thermally transferable dyes are transferred from selected areas of a dyesheet to a receiver material by localised application of heat, thereby to form an image. Full colour images can be produced in this way using dyes of the three primary colours, yellow, magenta and cyan. Mass transfer printing is another well known technique in which colorant material (commonly carbon black) is transferred from a mass transfer medium to a receiver material by localised application of heat. Mass transfer printing is generally used to print monochrome images, commonly text, bar codes etc. Dye diffusion thermal transfer printing and mass transfer printing are often used in conjunction with one another, with a common application being the printing of personalised cards such as identification cards, credit cards, driving licences etc, bearing a full colour image of the head of a person and text and/or a bar code in monochrome (usually black). Such printing is conveniently carried out using a dye sheet in the form of an elongate strip or ribbon of a heat-resistant substrate, typically polyethylene terephthalate film, carrying a plurality of similar sets of different coloured dye coats and colorant, each set comprising a panel of each dye colour (yellow, magenta and cyan) and a panel of colorant, with the panels being in the form of discrete stripes extending transverse to the length of the ribbon, and arranged in a repeated sequence along the length of the ribbon.

The resulting prints, particularly those in the form of cards, are frequently carried in plastic pouches, but plasticisers in the pouches are a particular problem because they are generally good solvents for thermal transfer dyes. A heavily plasticised PVC pouch, for example, can

extract virtually all the colour from an unprotected image. As a result it has become common practice to provide a layer of protective overlay material over prints produced in this way. The overlay makes the printed card or other material more secure by giving the image some degree of protection against abrasion and attack by plasticisers.

Overlay material is conveniently applied by thermal mass transfer, and to this end a ribbon-like dye sheet as described above conveniently also includes a panel of mass transfer overlay material in each set, downstream of the dye panels and colorant panel.

For overlay material to perform satisfactorily the material should have both good printability and good protective properties. For good printability the material should have good transfer characteristics, which require the material to fracture easily during the printing process, giving clean edges and a continuous coating of the printed overlay material. If the material does not fracture easily during printing the material instead tends to tear or rupture, producing images with jagged or ragged edges, exhibiting a phenomenon known as flashing. For good protective properties, the overlay should be flexible and durable and capable of withstanding rough treatment and hostile environments, such as elevated temperatures, particularly when carried in plastic pouches. To impart these properties, the overlay material needs to be tough and remain effectively continuous during prolonged use.

The requirements for good printability and good protective properties are difficult to reconcile in a single material.

Current commercially available overlay material achieves the transfer characteristics and durability requirements of the protective overlay by three different main routes. One method provides a thin layer of protective overlay ($<1\mu\text{m}$ quoted, but more commonly about $0.2\mu\text{m}$) of a very strong durable polymer, containing a high loading of a small particulate filler (US 5387573). A second method uses a multi-layer overlay comprising of a layer to aid release from the dyesheet substrate; a brittle, tough, durable polymer layer which has low adhesion to the receiver material; and an adhesion promoting layer to allow the protective layer to adhere to the receiver material (US 4977136). Another method uses a thick polymer layer of a very tough, durable polymer material which would normally have an unacceptable level of

flashing, with a very high loading of an ultra-violet light absorbing (UVA) filler material to achieve a lightfast overlay, with a low cohesive strength to allow good transfer (WO 98/07578).

Summary of the Invention

According to the present invention there is provided a thermal transfer medium comprising a substrate bearing on at least part of one surface thereof a coating layer of a thermally transferable overlay material for transfer onto a thermal transfer image formed on a receiver material, wherein the coating layer comprises polyester having a Tg greater than 50°C and a molecular weight in the range 6,000 to 10,000.

The polyester preferably has a Tg of at least 75°C.

Suitable commercially available polyesters include Skybon ES600-H (Skybon is a Trade Mark) from S K Chemicals, which has a Tg of about 80°C and a molecular weight of about 7,000, and Vylon GXW27 (Vylon is a Trade Mark) from Toyobo, which has a Tg of about 77°C and a molecular weight of about 7,500. Both of these materials are hydroxyl-terminated polyester resins. The polyester thus conveniently comprises a hydroxy-terminated polyester resin. In one embodiment the polyester has a Tg of about 80°C and a molecular weight of about 7,000 and in another the polyester has a Tg of about 77°C and a molecular weight of about 7,500. In these embodiments the polyester may be a hydroxy-terminated polyester resin.

Mixtures of suitable polyesters may be used.

By using a polyester having Tg and molecular weight characteristics as specified, it is surprisingly found that an overlay material in the form of a single layer of material (in contrast to multi-layer overlays of the prior art) which is highly transparent and has good transfer characteristics coupled with good barrier properties and durability can be provided.

The coating suitably has a thickness in the range 0.5 to 5.0 μm , preferably 1.5 to 3.5 μm , typically 1.6 to 2.0 μm .

Various additives may optionally be included in the coating, eg to enhance or add properties in known manner.

For example, filler materials such as inorganic filler eg silica (SiO_2), alumina (Al_2O_3) and titanium dioxide (TiO_2) can be used to lower the cohesive strength of the polymer layer to aid transfer, but also to improve durability and prevent 'blocking' (ie sticking) of the printed overlay to other materials such as card wallets. Optical brighteners (OB) eg Uvitex OB (from Ciba Geigy) (Uvitex is a Trade Mark) may be used to improve the colour of printed cards, as a tamper-proof measure in the overlay, and to aid registration in the film coating process. Ultra-violet light absorbers (UVA) eg Tinuvin (from Ciba Geigy) (Tinuvin is a Trade Mark) can be used to give protection to both the overlay to reduce yellowing, and an underlying dye diffusion print to reduce fading upon exposure to ultra-violet (UV) light.

The substrate may be any suitable heat-resistant material such as those known in the art. Suitable substrate materials include films of polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane. Biaxially oriented polyester film, particularly polyethylene terephthalate (PET), is currently favoured for its properties of mechanical strength, dimensional stability and heat resistance. The substrate suitably has a thickness in the range 1 to 20 μm , preferably 2 to 10 μm , typically about 6 μm .

The thermal transfer medium preferably includes a subcoat between the substrate and coating, particularly in the form of a releasing subcoat to assist release of the coating during printing. One preferred release subcoat comprises a crosslinked acrylic coating.

The thermal transfer medium desirably includes a heat-resistant backcoat, on the side of the substrate not carrying the coating, to resist applied heat in use in known manner.

The thermal transfer medium is conveniently in the form of a ribbon for use in thermal transfer printing, comprising a substrate having on one surface thereof a plurality of repeated

sequences of dye coats and mass transfer materials in the form of discrete stripes extending transverse to the length of the ribbon.

Thus in a preferred aspect the invention provides a thermal transfer medium, comprising an elongate strip of substrate materials having on one surface thereof a plurality of similar sets of thermally transferable dye coats and mass transfer layers, each set comprising a respective coat of each dye colour, yellow, magenta and cyan, and a respective mass transfer layer for colorant and overlay, each coat or layer being in the form of a discrete stripe extending transverse to the length of the substrate, with the sets arranged in a repeated sequence along the length of the substrate, wherein each overlay material mass transfer layer comprises a coating of an overlay material comprising polyester having a glass transition temperature (T_g) greater than 50°C and a molecular weight in the range 6,000 to 10,000.

The thermal transfer medium is conveniently made by dissolving or dispersing the overlay material in a suitable solvent as is well known in the art to give a coating liquid. Suitable solvents include methyl ethyl ketone (MEK), propanone, tetrahydrofuran, toluene, cyclohexanone etc. The coating liquid is then coated on the substrate and dried in known manner eg by bar coating, blade coating, air knife coating, gravure coating, roll coating, screen coating, fountain coating, rod coating, slide coating, curtain coating, doctor coating.

In a further aspect the invention provides a method of making thermal transfer medium, comprising forming on one surface of a substrate a coating of an overlay material comprising polyester having a glass transition temperature (T_g) greater than 50°C and a molecular weight in the range 6,000 to 10,000.

The thermal transfer medium is used in known manner for forming an overlay on a receiver material, frequently coupled with printing an image on suitable receiver material. The receiver material is typically in the form of a sheet or card of paper, cardboard, plastics material etc having a suitable image-receiving surface. The thermal transfer medium is placed in contact with the receiver material and localised heating effected to cause localised transfer of overlay material to form a protective overlay, commonly preceded by thermal transfer printing of dyes to produce a full colour image and mass transfer of colorant to

produce text, a barcode etc, on the receiver material. One common use of the thermal transfer medium is in production of identification cards, typically formed on a sheet of plastics material such as polyvinyl chloride, ABS and polyester, and which may bear a full colour photograph of the head of an individual, produced by thermal transfer printing, in combination with text and/or a bar code produced by mass transfer printing of colorant, and covered with a layer of overlay material.

The invention finds particular application for use with receiver material in the form of a card of PVC with an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer, and also with synthetic laminated paper receivers and voided polyester receivers.

In a further aspect the invention provides a method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with the invention and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.

The invention also includes within its scope the receiver material bearing an overlay produced in this way, particularly an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

The receiver material may optionally carry a further protective overlay (of similar or different constitution to the main overlay) on the opposed face.

The invention will be further described, by way of illustration, in the following examples.

Example 1 (comparative)

A coating solution (solution A) was prepared from

Vylon GK640	30% by weight	(Tg = 79°C / MWt. = 20,000)
manufactured by Toyobo		
MEK	70% by weight	

A coating was applied by hand using a Meier bar to give a wet coat about $6\mu\text{m}$ thick, onto a $6\mu\text{m}$ thick polyester substrate base film. The base film was already coated with a heat resistant backcoat to provide protection from a thermal head during the printing process, and subcoat comprising a cross-linked acrylic system subcoat to provide release of the coating during printing. The coating was dried initially by a hair drier, then in an oven at 110°C . for 30 seconds. The dry coat thickness was about $2.8\mu\text{m}$.

The subcoat comprises a highly cross-linked acrylic coating in which the cross-linking is achieved by UV-curing using a combination of photoinitiators and synergists included in the subcoat composition, details of which are given below. The subcoat was coated on the polyester to give a dry coat thickness of approximately $0.5\mu\text{m}$. The subcoat composition, expressed as % w/w, was as follows:

Chemical	% Composition	Manufacturer
MIBK	47.02%	Alcohols LTD
Uvecryl E1354	41.88%	UCB Radcure S.A
Diakon MG102	5.98%	KDT / Distrupol
Irgacure 907	1.68%	Ciba Geigy Plastics
Uvecryl P101	1.67%	UCB Radcure S.A
Quantacure ITX	0.84%	Lambson Fine Chemicals
Quantacure EPD	0.84%	Lambson Fine Chemicals
Cyan dye	0.08%	

MIBK is methyl iso-butyl ketone. This is the solvent from which the subcoat layer is deposited. The solvent is evaporated from the coating before it is subjected to UV-curing.

Uvecryl E1354 is a hexafunctional aromatic urethane acrylate oligomer. (Uvecryl is a Trade Mark.)

Diakon MG102 is a high molecular weight grade of poly methylmethacrylate. (Diakon is a Trade Mark.)

Irgacure 907, Uvecryl P101, Quantacure ITX & Quantacure EPD catalyse UV-curing of the Uvecryl E1354. (Irgacure, Uvecryl and Quantacure are Trade Marks.)

The resulting coating was spliced into a ribbon of dyesheet and was used to print onto a receiver comprising a card of polyvinyl chloride (PVC). The surface of the PVC card consists predominantly of a vinyl chloride/vinyl acetate copolymer (approximately 95:5 ratio, respectively). Printing was carried out using a Fargo Pro card printer (Fargo Pro is a Trade Mark) (manufactured by FARGO Electronics Incorporated).

The protective overlay was assessed for print transfer quality which showed very severe flashing and incomplete coverage of the PVC card. No cards were tested due to the unacceptable transfer characteristics.

Example 2 (comparative)

A coating solution (solution B) was prepared from

Vylon GK130	30% by weight ($T_g = 15^\circ\text{C}$ / MWt. range = 5,000 - 8,000)
manufactured by Toyobo	
MEK	70% by weight

A coating was applied as described in Example 1.

When the material was cut to size for splicing into a ribbon of dyesheet the samples all 'blocked' together into a clump of dyesheet, with each piece of dyesheet 'welded' to the piece above in the stack.

No cards were printed for testing.

Example 3

A coating solution (solution C) was prepared from

Vylon GXW27	30% by weight ($T_g = 77^\circ\text{C}$ / MWt. range = 7,500)
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MEK

70% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 2.9 μ m. The protective overlay was assessed for print transfer quality. The overlay has sharp clean edges and the coating is continuous over the printed area of card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay is equivalent or better than currently commercially available material. Test details are given below.

Example 4

A coating solution (solution D) was prepared from

Skybon ES600-H 30% by weight ($T_g = 80^\circ\text{C}$ / MWt. range = 7,000)

MEK 70% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.2 μ m. The protective overlay was assessed for print transfer quality. The overlay has sharp clean edges and the coating is continuous over the printed area of card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay is equivalent or better than currently commercially available material, with the exception of lightfastness where the polymer only overlay yellowed with exposure to UV light. Further testing with the inclusion of UVAs and OBs significantly reduced the yellowing of the overlay when exposed to UV light.

Example 5

A coating solution (solution C) was prepared from

Vylon GXW27	30% by weight ($T_g = 77^\circ\text{C}$ / MWt. range = 7,500)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a voided polyester receiver (CP15 Olmec Secure from ICI Imagedata – Olmec is a Trade Mark) using a CP15 printer (manufactured by Mitsubishi). The dry coat thickness was about 2.9 μm . The coating was assessed for transfer quality, which appeared very good. Further prints were made and tested for wallet barrier resistance (2), dye bleed and security properties. Test details are given below. In all tests performed the protective overlay is equivalent or better than currently commercially available material, with the exception of the dye bleed test, where the protective overlay allowed slightly more dye bleed than currently commercially available material (which allows slight dye bleed).

Example 6

A coating solution (solution D) was prepared from

Skybon ES600-H	30% by weight ($T_g = 80^\circ\text{C}$ / MWt. range = 7,000)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a voided polyester receiver (CP15 Olmec Secure) using a CP15 printer (manufactured by Mitsubishi). The dry coat thickness was about 3.2 μm . The coating was assessed for transfer quality, which appeared very good. Further prints were made and tested for wallet barrier resistance (2), dye bleed and security properties. In all tests performed the protective overlay is equivalent or better than currently commercially available material.

Example 7

A coating solution (solution C) was prepared from

Vylon GXW27	30% by weight ($T_g = 77^\circ\text{C}$ / MWt. range = 7,500)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a laminated paper receiver (CP700 Olmec Secure from ICI Imagedata) using a CP700 printer (manufactured by Mitsubishi) fitted with an HX EPROM. The dry coat thickness was about $2.9\mu\text{m}$. The coating was assessed for transfer quality, which appeared very good.

Example 8

A coating solution (solution D) was prepared from

Skybon ES600-H	30% by weight ($T_g = 80^\circ\text{C}$ / MWt. range = 7,000)
MEK	70% by weight

A coating was applied as described in Example 1, spliced into a ribbon of dyesheet and printed onto a laminated paper receiver (CP700 Olmec Secure from ICI Imagedata) using a CP700 printer (manufactured by Mitsubishi) fitted with an HX EPROM. The dry coat thickness was about $3.2\mu\text{m}$. The coating was assessed for transfer quality, which appeared very good.

Example 9

A coating solution was prepared from

Vylon GXW27	25% by weight ($T_g = 77^\circ\text{C}$ / MWt. range = 7,500)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight

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Uvitex OB (optical brightener

- Ciba Geigy

0.13% by weight

MEK

74.37% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.1µm. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Example 10

A coating solution was prepared from

Vylon GXW27

25% by weight ($T_g = 77^\circ\text{C}$ / MWt. range = 7,500)

Tinuvin 326 (UV absorber - Ciba Geigy)

0.5% by weight

Uvitex OB (optical brightener

- Ciba Geigy)

0.13% by weight

Aerosil MOX80 (silica filler - Degussa)

1.25% by weight

MEK

73.12% by weight.

A coating was applied and printed as described in Example 1. The dry coat thickness was about 3.1µm. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Example 11

A coating solution was prepared from.

Skybon ES600-H	25% by weight ($T_g = 80^\circ\text{C}$ / MWt. range = 7,000)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight
Uvitex OB (optical brightener - Ciba Geigy)	0.13% by weight
MEK	74.37% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about $3.1\mu\text{m}$. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Example 12

A coating solution was prepared from.

Skybon ES600-H	25% by weight ($T_g = 80^\circ\text{C}$ / MWt. range = 7,000)
Tinuvin 326 (UV absorber - Ciba Geigy)	0.5% by weight
Uvitex OB (optical brightener - Ciba Geigy)	0.13% by weight
Aerosil MOX80 (silica filler - Dugussa)	1.25% by weight
MEK	73.12% by weight

A coating was applied and printed as described in Example 1. The dry coat thickness was about 2.9 μ m. The protective overlay was assessed for print transfer quality. The overlay had sharp clean edges and the coating was continuous over the printed area of the card.

Further cards were produced and tested for durability (Taber test and tumble test), lightfastness and wallet barrier resistance (1) and compared to currently commercially available material. In all tests performed the protective overlay was equivalent or better than currently commercially available material.

Test Methods

Durability (1) - Taber Abrasion

The object of this test is to simulate the everyday abrasive wear to the protective overlay on the PVC card surface which may be expect throughout the lifetime of the card.

After printing the card with a special optical density (OD) image designed for test purposes, with protective overlay as described in the Examples, the card is notched along the centre of the low optical density long edge of the card to allow the card to be mounted as one of a pair of test cards on the turntable of the Taber 5130 Abrader (Taber is a Trade Mark) (manufactured by Teledyne Taber) which wears down the surface of the card with two abrasive rubber wheels under a specific load, driven by the sample in opposite directions.

The other card of the test pair is printed with a currently commercially available protective overlay. The card pair is then abraded for 100 cycles using CS-10F wheels, 1kg extra weight and a 70% vacuum level.

The performance of the development protective overlay is then be graded against the commercially available material.

Good samples will show no loss of image but the protective overlay will be scuffed; poor samples will have worn completely through to the card surface.

Durability (2) - Tumble Test

The object of this test is to simulate everyday wear of a card, including handling, flexing, heat and humidity, and abrasion.

After printing with an optical density image (as used in the Taber test) and protective overlay (as described in the Examples), cards are flexed 100 times along the length of the card (image extension) using a testing machine referred to as an AutoFlexer machine. The AutoFlexer machine comprises of a pair of jaws, one fixed the other free to move in a forwards/backwards motion. A motor drives the jaws with a movement of 12mm and a closed gap of 41mm with the cards flexing in the short direction (the set up may be altered to flex the cards in the long direction with a closed gap of 55mm). The jaws can accommodate a maximum of 4 test cards. The cards are flexed at 0.5 Hz.

After applying Veriderm cream (a hand cream designed to simulate natural finger grease, manufactured by Upjohn) (Veriderm is a Trade Mark) to the imaged surface, the card is placed in a 45°C/85%RH (relative humidity) oven for 24 hours. The cards are then placed around the inside surface of a cylindrical container (with the image facing inwards) filled with a selection of nuts and bolts (to simulate pocket change, keys, etc.). The lid of the container is then sealed and the container is tumbled on a set of rollers at a speed of about 20 rpm for two hours. The cards are then removed, wiped clean of any excess grease, and graded according to the level of damage to the card surface, as compared to currently commercially available material.

Good samples will show no loss of image but the protective overlay may be scuffed; poor samples will have worn completely through to the card surface.

Wallet Barrier (1)

After printing with an optical density image (as used in the Taber test) and protective overlay (as described in the Examples), cards are flexed 100 times along the length of the card

(image extension) using the AutoFlexer machine. The flexed region of the card is examined by optical microscope and a print made of any damage visible. A piece of the internal surface of a PVC card wallet (as commonly used to clip an id card to clothing) is placed over the imaged surface of the card, which is then placed under a 1.2kg mass in a 50°C oven for 72 hours. Unflexed cards are also tested to indicate whether any dye bleed is due to insufficient barrier properties of the protective overlay or to fracturing of the protective overlay during flexing. The samples are removed from the oven, separated and graded according to the extent of dye bleed through the protective overlay onto the PVC wallet, as compared to currently commercially available material.

Good samples will have no dye bleed on to the PVC wallet material; poor samples will show dye bleed even on unflexed cards.

Lightfastness

After printing with an optical density image (as used in the Taber Test) and protective overlay (as described in the Examples), cards are measured using a MacBeth TR 1224 densitometer (manufactured by MacBeth Division of Kollmorgen Instruments Corporation) (MacBeth is a Trade Mark). The samples are then placed in an Atlas Ci35 Fade-ometer (manufactured by Atlas Electric Devices Company) (Atlas and Fade-ometer are Trade Marks) for exposure to:-

1.5w/m² measured at 420nm

290J/m² measured at 420nm

50%RH

The cards are then re-measured and the percent optical density loss recorded, and graded for % OD loss and a visual assessment as compared to currently commercially available material.

Good samples will be visibly brighter and more vibrant, with a low % OD loss measured; poor samples will be visibly faded in conjunction with a high % OD loss measured.

Wallet Barrier (2)

After printing with a suitable image and protective overlay, the printed surface is placed in contact with plasticised PVC wallet material, under a 1.2kg mass in a 45°C/85%RH oven for 15 days. The samples are removed from the oven, separated and graded according to the extent of dye bleed through the protective overlay onto the PVC wallet material, as compared to currently commercially available material. No dye should be seen to bleed onto the PVC wallet material.

Dye Bleed

The overlay was designed to protect the dye diffusion image from low molecular weight, migratable materials, resident in lamination overlay adhesives. These materials, should they enter the receiver layer, would cause the dyes to move, fuzzing out the detail in the photographs. This test assesses the effectiveness of the overlay to protect the image from the adhesive migratables.

Two prints of four passport size portraits images with protective overlay are made. An adhesive thermal indicator strip is placed on an unprinted area of the receiver, and HMSO approved laminate is placed over both the imaged area and thermal indicator strip.

Test laminates incorporating thermal indicator strips are made to verify that the lamination conditions are with 99 - 104°C; then test prints are laminated.

The two prints are placed in an oven set to 80°C for 96 hours (4 days).

To pass the test there must be no visible degradation of the image after ageing.

Security Test

A single portrait image is cut from a print of four passport sized portrait images with protective overlay, and the printed image is secured using double sided adhesive tape to a

piece of paper card. HMSO approved laminate is applied over the printed image and card, having previously made test laminates incorporating thermal indicator strips to verify the lamination conditions of 99 - 104°C.

Once cool the laminate around the print is cut using a scalpel.

The laminate is peeled slowly back, by hand, away from the print through 180°. To pass the test the damage to the imaged surface must be such that neither the print or laminate can be re-used.

Summary of Results

Grading system

2 much better than current commercially available material

1 better than current commercially available material

0 as current commercially available material

-1 worse than current commercially available material

-2 much worse than current commercially available material

Example Ref	Transfer	Taber	Tumble	Wallet Barrier (1)	Light fastness	Wallet Barrier (2)	Dye Bleed	Security
1	-2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	0	0	0	1	1	n/a	n/a	n/a
4	0	0	0	1	1	n/a	n/a	n/a
5	0	n/a	n/a	n/a	n/a	0	-1	0
6	0	n/a	n/a	n/a	n/a	0	1	0
7	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a

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8	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
9	0	0	0	1	1	n/a	n/a	n/a
10	0	0	0	1	1	n/a	n/a	n/a
11	0	0	0	1	1	n/a	n/a	n/a
12	0	0	0	1	1	n/a	n/a	n/a

Claims

1. A thermal transfer medium comprising a substrate bearing on at least part of one surface thereof a coating layer of a thermally transferable overlay material for transfer onto a thermal transfer image formed on a receiver material, wherein the coating layer comprises polyester having a Tg greater than 50°C and a molecular weight in the range 6,000 to 10,000.
2. A thermal transfer medium according to claim 1, wherein the polyester has a Tg of at least 75°C.
3. A thermal transfer medium according to claim 1 or 2, wherein the polyester has a Tg of about 80°C and a molecular weight of about 7,000.
4. A thermal transfer medium according to claim 1 or 2, wherein the polyester has a Tg of about 77°C and a molecular weight of about 7,500.
5. A thermal transfer medium according to any one of the preceding claims, wherein the coating further comprises filler material.
6. A thermal transfer medium according to any one of the preceding claims, wherein the coating further comprises one or more ultra-violet light absorbers.
7. A thermal transfer medium according to any one of the preceding claims, wherein the coating further comprises one or more optical brighteners.
8. A thermal transfer medium according to any one of the preceding claims, wherein the substrate comprises a film of heat-resistant material selected from polyesters, polyamides, polyimides, polycarbonates, polysulphones, polypropylene and cellophane.

9. A thermal transfer medium according to any one of the preceding claims, wherein the coating has a thickness in the range 0.5 to 5.0 μ m, preferably 1.5 to 3.5 μ m, typically 1.6 to 2.0 μ m.
10. A thermal transfer medium according to any one of the preceding claims, further comprising a subcoat between the substrate and coating.
11. A thermal transfer medium according to claim 11, comprising a cross-linked acrylic subcoat.
12. A thermal transfer medium according to any one of the preceding claims, wherein the other surface of the substrate has a heat-resistant backcoat.
13. A thermal transfer medium, comprising an elongate strip of substrate material having on one surface thereof a plurality of similar sets of thermally transferable dye coats and mass transfer layers, each set comprising a respective coat of each dye colour, yellow, magenta and cyan, and a respective mass transfer layer for colorant and overlay, each coat or layer being in the form of a discrete stripe extending transverse to the length of the substrate, with the sets arranged in a repeated sequence along the length of the substrate, wherein each overlay material mass transfer layer comprises a coating of an overlay material comprising polyester having a glass transition temperature (T_g) greater than 50°C and a molecular weight in the range 6,000 to 10,000.
14. A method of making a thermal transfer medium, comprising forming on one surface of a substrate a coating of an overlay material comprising polyester having a glass transition temperature (T_g) greater than 50°C and a molecular weight in the range 6,000 to 10,000.
15. A method of forming an overlay on a receiver material, comprising superposing a thermal transfer medium in accordance with any one of claims 1 to 13 and a receiver material; and applying localised heating to the thermal transfer medium to form an overlay on the receiver material.

16. A method according to claim 15, further comprising producing a printed image on the receiver material by thermal transfer printing prior to formation of the overlay.
17. Receiver material bearing an overlay produced by the method of claim 15 or 16.
18. Receiver material according to claim 17, comprising a card of polyvinyl chloride.
19. Receiver material according to claim 17 or 18, wherein the receiver material has an image-receiving surface comprising vinyl chloride/vinyl acetate copolymer.
20. Receiver material according to claim 17, 18 or 19, in the form of an identification card bearing a full colour image produced by thermal transfer printing and text and/or a bar code produced by mass transfer printing of colorant.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
22 February 2001 (22.02.2001)

PCT

(10) International Publication Number
WO 01/12448 A1

(51) International Patent Classification⁷: **B41M 7/00**,
B42D 15/10, B41M 5/00

(21) International Application Number: PCT/GB00/02794

(22) International Filing Date: 20 July 2000 (20.07.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9919159.5 14 August 1999 (14.08.1999) GB

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(81) Designated States (*national*): JP, US.

(84) Designated States (*regional*): European patent (AT, BE,
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,
NL, PT, SE).

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: THERMALLY-TRANSFERABLE POLYESTER IMAGE-PROTECTING LAYER

(57) Abstract: A thermal transfer medium for use in mass transfer printing comprises a substrate bearing on at least part of one surface thereof a coating of an overlay material comprising polyester having a glass transition greater than 50 °C (preferably at least 75 °C) and a molecular weight in the range 6,000 to 10,000. The overlay material combines good transfer characteristics, barrier properties and durability and is highly transparent.

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Rule 56(a) & (b) = 37 C.F.R. 1.56(a) & (b)
PATENT AND TRADEMARK CASES - RULES OF PRACTICE
DUTY OF DISCLOSURE

- (a) ... Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the [Patent and Trademark] Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability... (b) information is material to patentability when it is not cumulative and (1) It also establishes by itself, or in combination with other information, a prima facie case of unpatentability of a claim or (2) refutes, or is inconsistent with, a position the applicant takes in: (i) Opposing an argument of unpatentability relied on by the Office, or (ii) Asserting an argument of patentability

PATENT LAWS 35 U.S.C.

§102. Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless--

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent or
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
- (c) he has abandoned the invention, or
- (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months* before the filing of the application in the United States, or
- (e) the invention was described in
 - (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
 - (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a); or
- (f) he did not himself invent the subject matter sought to be patented, or
- (g)
 - (1) during the course of an interference conducted under section 135 or section 291, another inventor involved therein establishes, to the extent permitted in section 104, that before such person's invention thereof the invention was made by such other inventor and not abandoned, suppressed, or concealed, or
 - (2) before such person's invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or concealed it. In determining priority of invention under this subsection there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

§103. Condition for patentability; non-obvious subject matter

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made. . . .
- (c) Subject matter developed by another person, which qualified as prior art only under one or more of subsections (e), (f) and (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

* Six months for Design Applications (35 U.S.C. 172).

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ORIGINAL/SUBSTITUTE/SUPPLEMENTAL
DECLARATIONS

RULE 63 (37 C.F.R. 1.63)
DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PW
FORM

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the **INVENTION ENTITLED**
THERMALLY-TRANSFERABLE POLYESTER IMAGE-PROTECTING LAYER

the specification of which (CHECK applicable BOX(ES))

X
BOX(ES) → A. ☐ is attached hereto
→ B. ☐ was filed on _____ as U.S. Application No. _____ /
→ C. ☒ was filed as PCT International Application No. PCT/ GB00/02794 on 20 July 2000

and (if applicable to U.S. or PCT application) was amended on _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. Except as noted below, I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International Application which designated at least one other country than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application:

PRIOR FOREIGN APPLICATION(S)

Number	Country	Day/MONTH/Year Filed	Date first Laid-open or Published	Date Patented or Granted	Priority NOT Claimed
9919159.5	Great Britain	14 August 1999			

If more prior foreign applications, X box at bottom and continue on attached page.

Except as noted below, I hereby claim domestic priority benefit under 35 U.S.C. 119(e) or 120 and/or 365(c) of the indicated United States applications listed below and PCT international applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application:

PRIOR U.S. PROVISIONAL, NONPROVISIONAL AND/OR PCT APPLICATION(S)

Application No. (series code/serial no.)	Day/MONTH/Year Filed	Status	Priority NOT Claimed
PCT/GB00/02794	20 July 2000	pending, abandoned, patented	pending

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint Pillsbury Winthrop LLP, Intellectual Property Group, telephone number (703) 905-2000 (to whom all communications are to be directed), and persons of that firm who are associated with USPTO Customer No. 909 (see below label) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete from that Customer No. names of persons no longer with their firm, to add new persons of their firm to that Customer No., and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/ organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above firm and/or an attorney of that firm in writing to the contrary.

USE ONLY FOR
PILLSBURY WINTROP



00909

(1) INVENTOR'S SIGNATURE:

Date: 25th APRIL 2002

Name	Julie	LC	Double
First	Middle Initial	Family Name	
Residence	Ipswich	Suffolk, United Kingdom	United Kingdom
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(2) INVENTOR'S SIGNATURE:

Date: 25th APRIL 2002

Name	Andrew	Clifton
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☒ FOR ADDITIONAL INVENTORS see attached page.

☐ See additional foreign priorities on attached page (incorporated herein by reference).

Atty. Dkt. No. P0284989

(M#)

DECLARATION AND POWER OF ATTORNEY

(continued)

ADDITIONAL INVENTORS:

(3) INVENTOR'S SIGNATURE:

A Butters

Date: 25 April 2002

Alan		Butters	
First	Middle Initial	Family Name	
Residence	Capel St Mary	Suffolk, United Kingdom	United Kingdom
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(4) INVENTOR'S SIGNATURE:

Date:

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Residence	City		State/Foreign Country
Mailing Address		Country of Citizenship	
(include Zip Code)			

(5) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial	Family Name
Residence	City		State/Foreign Country
Mailing Address		Country of Citizenship	
(include Zip Code)			

(6) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial	Family Name
Residence	City		State/Foreign Country
Mailing Address		Country of Citizenship	
(include Zip Code)			

(7) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial	Family Name
Residence	City		State/Foreign Country
Mailing Address		Country of Citizenship	
(include Zip Code)			

(8) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial	Family Name
Residence	City		State/Foreign Country
Mailing Address		Country of Citizenship	
(include Zip Code)			

(9) INVENTOR'S SIGNATURE:

Date:

First		Middle Initial	Family Name
Residence	City		State/Foreign Country
Mailing Address		Country of Citizenship	
(include Zip Code)			